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EXAMINER	
RUGGLES, JOHN S	
ART UNIT	**PAPER NUMBER**
1756	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/624,546	UDA ET AL.	
	Examiner	Art Unit	
	John Ruggles	1756	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 July 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *3-8 and 10-13* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *3-8 and 10-13* is/are rejected.

7)☒ Claim(s) *8* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *23 July 2003* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☒ Certified copies of the priority documents have been received in Application No. 09/951,612.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *23 July 2003*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

In the preliminary amendment filed on 23 July 2003, Applicants have cancelled claims 1-2 and 9 and amended claims 5-8 and 11-13. Therefore, only claims 3-8 and 10-13 remain under consideration.

Priority

Acknowledgment is made of Applicants' claim for foreign priority under 35 U.S.C. 119(a)-(d). The certified copy has been filed in parent Application No. 09/951,612, filed on 14 September 2001.

Drawings

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference characters "13′" (shown in Figure 4D) and "31" (found throughout the description of Figure 4D at page 29 line 26 to page 30 line 8 at several occurrences) have both been used to designate the Figure 4D second exposure mask having narrower exposure openings than the first exposure mask 13 shown in Figure 4B.

The drawings are also objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: (1) exposure light 17 described at page 29 line 26 has not been labeled in Figure 4D and (2) substrate 11 described at page 32 lines 12-18 has not been labeled in Figure 5A.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet,

even if only one figure is being amended. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance. This paragraph applies to both of the above drawings objections.

Figures 11A, 11B, 12, 13A, 13B, 13C, and 13D should all be designated by a legend such as --Prior Art-- because only that which is old is illustrated. Applicants have admitted at page 1 lines 10-11 and page 13 lines 12-16 that these figures represent "conventional" subject matter. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.121(d)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

The amended title of the invention is not fully descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed. Namely, it is unclear from the currently amended title whether the claimed invention is directed to (1) only methods of manufacturing or (2) (a) a method of manufacturing an electroconductive film and (b) a resulting image forming apparatus including the electroconductive film. A reading of the claims reveals

that the former interpretation (1) better describes Applicants' invention as currently claimed and should therefore be clearly reflected in the corresponding title.

The following title is suggested: Method of Manufacturing an Electroconductive Film and ***Method of Manufacturing*** an Image Forming Apparatus Including the Electroconductive Film (emphasis added).

The abstract of the disclosure is objected to because it is not representative of Applicants' currently claimed invention, but is instead drawn to a different embodiment that has been cancelled from the instant claims. Correction is required. See MPEP § 608.01(b).

Applicants' assistance in correcting errors in the specification by a preliminary amendment filed on 23 July 2003 is acknowledged. However, the specification is still replete with terms, which are not clear, concise and exact. The specification should again be revised carefully in order to comply with 35 U.S.C. 112, first paragraph. Examples of some remaining unclear, inexact or verbose terms used in the specification are: (1) at page 7 lines 9-10, "ratio of B to A in Figs. 13A to 13D" should be changed to --ratio of B to A in Fig. 13D--, because only Figure 13D shows the referenced dimensions labeled as "A" and "B"; (2) at page 11 lines 13-14, "the photosensitive material is a negative step" should be changed to --the photosensitive material is a negative type--, as an alternative to the "positive type" photosensitive material found at page 11 line 15; (3) at page 15 lines 8-9, "19 denotes a developing pattern as a developer" should be changed to --19 denotes a developed pattern--; (4) at page 17 lines 14-15 "the exposure is repeated twice as described above" suggests three exposure steps, but only two

exposure steps are actually successively carried out in overlapping fashion, so this phrase should be changed to, e.g., --exposure is carried out twice as described above--, etc., if this best represents Applicants' original intention with respect to the two exposure steps represented by Figures 1B and 1C (similar changes should also be made at page 22 line 14, page 23 line 14, page 27 line 17, page 28 line 11, page 30 line 25, and page 33 line 12); (5) at page 22 line 24, --paste-- has been misspelled; and (6) at page 23 line 23, --curling-- has been misspelled (other occurrences of this misspelling are also found at page 28 line 24, page 31 lines 3 and 11, page 33 lines 18 and 26, and page 36 lines 4 and 12). Note that due to the number of errors, those listed here are merely *examples* of the remaining changes required in the specification and do *not* represent an exhaustive list thereof.

Appropriate correction is required. An amendment filed making all appropriate corrections must be accompanied by a statement that the amendment contains no new matter and also by a brief description specifically pointing out which portion of the original specification provides support for each of these corrections.

Claim Objections

Claim 8 is objected to under 37 CFR 1.75(c) as being in improper form because a multiple dependent claim cannot depend from any other multiple dependent claim. In this case claim 8 depends on any one of claims 3-7, but claim 7 also depends on any one of claims 3-6. See MPEP § 608.01(n). Accordingly, claim 8 has not been further treated on the merits.

Claim 8 is also objected to because of the following informalities: (1) in lines 1-2, "A method of manufacturing image forming apparatus" should be changed to --A method of

manufacturing an image forming apparatus--; (2) in line 3, "forming a first and second wirings" should be changed to --forming first and second wirings--; and (3) in line 6, "first and second wiring" should be changed to --first and second wirings--, all to be grammatically correct. Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 7-8 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for (1) --wherein a film thickness after said baking step is ***about 14 μm to about 18 μm***--, the specification does not reasonably provide enablement for (2) "wherein a film thickness after said baking step is **5 μm or more**" (emphasis added, as recited in claim 7). The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the invention commensurate in scope with these claims. Page 23 lines 4-12 (for a plural layer baked wiring pattern having a thickness of about 14 μm to 18 μm in reference to Figure 2F), page 27 line 27 to page 28 line 9 (for a thickness of about 14 μm to 17 μm in Figure 3H), page 30 lines 15-23 (for a thickness of about 14 μm to 17 μm in Figure 4F), page 33 lines 4-11 (for a thickness of about 14 μm to 16 μm in Figure 5H), and page 35 lines 15-24 (for a thickness of about 14 μm to 17 μm in Figure 6F) provide enablement for (1) above, but do not reasonably provide enablement for (2) above. The broadest reasonable interpretation of (a) the lower boundary of 5 μm and (b) especially the unbounded upper limit for

the (electroconductive) plural layer combined thickness after baking is well beyond the scope set out in the specification as indicated above. Claim 8 depends on claim 7.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter, which the applicant regards as his invention.

Claims 3-8 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 3 line 6, the phrase "to laminate said films on each other" has been interpreted to mean --to laminate each second or subsequent film layer on each previous film layer--. This is in accordance with the second to sixth embodiments shown in Figures 2A-2F, 3A-3H, 4A-4F, 5A-5H, and 6A-6F described at page 14 line 19 to page 36 line 24. Claims 4-8 depend on claim 3.

In claim 3 line 7, the phrase "the latent images" lacks proper antecedent basis. Claims 4-8 depend on claim 3.

In claim 4 line 2, the phrase "the laminated second and subsequent layers" lacks proper antecedent basis. Claims 5-8 depend on claim 4.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person

having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 3, 7, and 10-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Masaki et al. (Japanese Patent Publication 8-227153 A) in view of Felton (US Patent 5,874,197) and further in view of either Bae et al. (US Patent 5,830,624) or Dentinger et al. (US Patent 5,830,624).

Masaki teaches a process of manufacturing a patterned thick film electrode, which is 5-30 microns (μm) thick after baking (instant claim 7, fully encompassing that portion (***about 14 μm to about 18 μm***) of the recited thickness of "**5 μm or more**" that is actually supported by the instant disclosure, as pointed out above), for a plasma display panel (PDP, electric field discharge type for emission of electrons). The electrode is formed from an electroconductive photosensitive paste (instant claim 11) including an ultraviolet rays extinction agent (ultraviolet (UV) absorber), glass frit, and metal (e.g., silver (Ag), copper (Cu), etc., instant claim 12) powder (which reads on electroconductive grains, instant claim 13) at paragraphs [0004, 0011-0012, 0035, 0048, 0052, and 0082]. The electroconductive paste is applied to a substrate by forming a film on a substrate, usually by screen printing onto a glass substrate [0076], heating to evaporate solvent, irradiating light onto the film through a patterned mask to harden the exposed region [0078], developing to remove the portion not hardened by exposure to form a negative (resist) pattern [0079], and calcining or baking in air of the remaining exposed and hardened pattern [0080] (instant claim 3). The resulting baked electroconductive pattern is represented to be of high definition without edge curl at paragraph [0097].

Masaki does not specifically teach forming a second film on the first exposed film having a first latent image, exposing the second film by irradiating light onto a region of the second film to form a second latent image in the second film over the first latent image, and optionally repeating the film forming step and the exposure step to form an optional third latent image in the third film over the second latent image in the second film.

Felton shows a process of manufacturing a patterned electroconductive thick film, which is 4-20 μm thick after sintering or baking (column 2 lines 21-22) from an electroconductive photosensitive paste as a photoresist. Felton acknowledges that the metal powders used in the prior art electroconductive photosensitive paste or photoresist are opaque. So, the surface of the prior art electroconductive photoresist must be overexposed to achieve crosslinking beneath the surface. But, this overexposure leads to undercut of the patterned edges during developing and subsequent edge curl after sintering at high temperatures (column 1 lines 12-25). Felton shows improved particle size selection to substantially improve particle packing and enhance light penetration (column 2 lines 39-41). An additional benefit of optimized particle size is reduction in the necessary thickness of films before patterning (column 2 lines 41-43). The preferred prior art particle size distribution (PSD) in the industry is monomodal at 2-3 μm average; smaller particles with monomodal PSD absorb light excessively and photopolymerization is retarded (column 2 lines 43-47). Intense light exposure even with 2-3 μm PSD is necessary to penetrate the film, resulting in high resolution and good edge definition for finished lines having a thickness of 6 μm or less (column 2 lines 47-51). Opacity of the films having metal powder causes edge curl at greater thicknesses, with the onset of cracking at 8-9 μm fired thickness (column 2 lines 51-55). Felton proposes preferred trimodal or bimodal PSDs for the

electroconductive metal powder (e.g., silver (Ag), gold (Au), other conductive solids, etc., column 2 line 58 to column 3 line 27). Alternatively, Felton proposes an electroconductive film photoresist including a thermal catalyst (for additional cross-linking in the photoresist to supplement that caused by a smaller amount of UV imagewise exposure to reduce edge curl distortion, column 3 line 47 to column 4 line 3), glass frit (column 5 lines 35-38), and metal powder. The electroconductive paste as photoresist is coated on a substrate (e.g., by silk screening, etc., column 9 lines 28-32), thermally treated to drive off solvent and cause some thermally induced polymerization (column 9 lines 34-37), further thermal curing just short of becoming insoluble in a developer solution (column 9 lines 47-48), then a relatively small amount of UV patterned exposure (column 9 lines 49-51), optionally more partial thermal curing (column 9 line 54 to column 10 line 2), developing to remove the unexposed areas or regions (to form a negative resist image, column 10 lines 2-14), and firing or baking (column 10 lines 14-15). Felton points out that reduction in the amount of UV exposure results in beneficial reduction in edge curl and pattern undercut at column 9 lines 58-64. In summary, Felton points out three ways to reduce edge curl: (1) reducing the electroconductive photosensitive film thickness, (2) optimizing the metal PSD in the film, and/or (3) addition of a thermal catalyst in the film to enhance cross-linking even at reduced amount of UV exposure during imaging (especially for thicker films).

Bae teaches a method for forming plural stacked resist patterns (abstract, column 1 lines 14-19). Figures 7-10 illustrate an embodiment involving the sequential steps described at column 4 lines 1-44. The resulting stacked and aligned latent images are then developed in a common step to remove regions 21 of the second resist 16, the underlying portions of ARC 15,

and the underlying regions 20 of the first resist 13, as shown in Figure 10 (which is similar to instant Figure 2E). Figure 11 shows a different embodiment having an additional overlying third resist 59, which would be patterned using a similar sequence as that shown by Figures 7-10, to form a multilayer resist film having a thickness of 7-8 μm (this three layer resist pattern would be similar to that shown by instant Figure 3G). Accordingly, the resulting resist pattern has a vertical profile (column 4 lines 45-57).

Dentinger teaches a multilayer microstructure and a method of making it by applying a first photodefinable composition or resist, exposing the first resist to a first wavelength pattern, applying a second resist over the first exposed resist, exposing the second resist to a second wavelength pattern overlapping the first exposed regions, then developing the overlapping latent regions of the first and second resists to form a combined multilayer microstructure (abstract). The overlapping latent image regions of the first and second resists can be either (1) the same size and aligned with each other to form a multilayer microstructure having a cavity with an aspect ratio of at least 30:1 (40:1 if each resist opening has an aspect ratio of 20:1) as shown in Figures 2A-2C (column 4 lines 48-67, column 7 line 26 to column 8 line 43) or (2) offset with each other as shown in Figure 3C (column 5 lines 1-25, column 8 line 44 to column 9 line 35).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to reduce the edge curl of an electroconductive thick film pattern as taught by Masaki by reducing the thickness of the film in order to reduce the degree or intensity of patterned exposure required to penetrate through the film, which would result in reduced edge curl, as shown by Felton. Even though Bae and Dentinger illustrate multilayer resist patterning for plural positive resist layers from which the latent image area of each exposed resist layer is

removed during a common developing step, a similar effect would also be expected by one of ordinary skill in the art for multilayer negative resist layers from which the non-latent image area of each exposed resist layer is removed, such as for the electroconductive pastes used by Masaki and Felton. The thick film made from electroconductive paste of Masaki and Felton would then be formed in plural layers, each layer being imaged in turn, with all overlapping latent images developed in a single combined step for building up stacked resist patterns in the manner taught by either Bae to form a vertical combined profile or Dentinger to form a high aspect ratio combined profile (which may be vertically aligned or offset as desired). This combined resist profile of plural patterned resist layers would then be baked in the same manner as taught by Masaki and Felton for a single layer electroconductive thick film. The motivation for breaking up the thick electroconductive film of Masaki and Felton into several thinner stacked overlapping electroconductive photosensitive paste films as suggested by either Bae or Dentinger would be to form vertical or high aspect ratio patterns, respectively, while reducing edge curl in the thick electroconductive patterned film by breaking up the thick film into plural thinner layers of the film in order to reduce the degree or intensity of patterned exposure required to penetrate through each film as taught by Felton.

Applicants cannot rely upon the foreign priority papers to overcome this rejection because a translation of said papers has not been made of record in accordance with 37 CFR 1.55. See MPEP § 201.15.

Claims 4-5 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Masaki et al. (Japanese Patent Publication 8-227153 A) in view of Felton (US Patent 5,874,197), further

in view of either Bae et al. (US Patent 5,830,624) or Dentinger et al. (US Patent 5,830,624), further in view of Osawa (Japanese Patent Publication 6-077106 A), and further in view of either Bloomstein et al. (US Patent 6,777,170) or Bloomstein et al. (US Patent 6,833,234).

While teaching the other aspects of claims 4-5 and 7 for formation of a baked multilayer electroconductive patterned thick film, Masaki, Felton, and either Bae or Dentinger do not specifically teach forming each successive layer of the thick film to have a width or size different from than that of the previous layer.

Osawa discloses formation of an electrode by a lift-off method that involves patterning a single layer photoresist, first by peripheral exposure through a first mask pattern, then by overlapping narrower peripheral or central exposure through a different mask pattern having a smaller opening region of the same photoresist layer (positive resist, paragraphs [0009-0010], Figures 1 (a-c)). The double exposed photoresist is baked in an ammonia (NH_4) atmosphere to treat or reverse the image in the photoresist (i.e., to selectively deteriorate regions of the resist so that unexposed regions are removed during developing [0011], thereby leaving a negative resist image). The sequence of exposures may be reversed (i.e., central, then peripheral), but the resulting image would be completely the same [0015]. Also, the same result would be obtained by using a negative photoresist, but without the baking reversal step [0016]. Figure 3 as described in paragraph [0013] shows the effect of differing degrees of exposure on the patterned photoresist profile. The first peripheral exposure of a resist using a low amount of light results in a profile A as shown in Figure 3 whereas the subsequent central exposure of this same resist adds more light to this central portion and results in a profile E, also shown in Figure 3. Therefore, the combination of profiles A and E leads to a resist image combined profile shown in Figure 2,

which has a vertical lower edge portion and a steeply backward rounded sloped upper edge, referred to as "eaves" [0012-0013]. Using a negative resist followed by reversal baking or a positive resist without any reversal baking would be expected to result in a reverse of the image in Figure 2. Therefore, when using a negative resist instead of a positive resist in this sequence of peripheral exposure and subsequent overlapping central exposure followed by reversal baking, the corresponding combined effect would be the reverse image of Figure 2. In this case, the resulting negative resist combined profile after reversal baking would have vertical lower edges and rounded upper corners on these edges.

Bloomstein '170 teaches methods for stereolithographic patterning of successive resist layers to build up a stepped profile *by variable dose light delivery* for each successive layer of resist as shown in Figures 2 and 12A (title, abstract, column 1 lines 24-28, column 12 lines 40-45, column 23 lines 35-36). As shown in Figure 2, variable doses are used over different portions of each layer such that the central regions represented by thicker lines 220, 230, and 240 receive higher (exposure) doses (column 12 lines 46-48, column 20 lines 46-49). The method may further include (1) developing the resist layers in a single subsequent step (e.g., reducing development time, etc.) to remove either (a) exposed portions of positive resist layers or (b) unexposed portions of negative resist layers and (2) heating the multilayer resist after exposure of at least one portion (column 3 line 65 to column 4 line 6). Stereolithographic patterning in accordance with this method offers greater optimization of structural elements and increased flexibility in design (column 1 lines 41-44).

Similarly, Bloomstein '234 teaches methods for stereolithographic patterning of successive resist layers to build up a stepped profile *by variable size exposure* for each

successive layer of resist as shown in Figures 2 and 12A (title, abstract, column 1 lines 24-28, column 12 lines 40-45, column 23 lines 38-39). As shown in Figure 2, variable doses are used over different portions of each layer such that the central regions represented by thicker lines 220, 230, and 240 receive higher (exposure) doses (column 12 lines 46-48, column 20 lines 46-49). The method may further include (1) developing the resist layers in a single subsequent step (e.g., reducing development time, etc.) to remove either (a) exposed portions of positive resist layers or (b) unexposed portions of negative resist layers and (2) heating the multilayer resist after exposure of at least one portion (column 3 line 65 to column 4 line 6). Stereolithographic patterning in accordance with this method offers greater optimization of structural elements and increased flexibility in design (column 1 lines 41-44).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to further reduce the edge curl of a built-up thick multilayer electroconductive film structure taught by Masaki, Felton, and either Bae or Dentinger having several thinner stacked overlapping electroconductive photosensitive paste films (1) by reducing the degree or intensity of patterned exposure for each photosensitive electroconductive film layer as shown by Felton and either Bae or Dentinger and/or (2) by further reducing the width or size of patterned exposure through a different mask pattern having a smaller opening region (instant claims 4-5 and instant claim 7 for the reasons discussed above), especially to reduce exposure along the edge of the profile as shown by Osawa for obtaining vertical lower edges and rounded upper corners on these edges of each photosensitive electroconductive film layer. Even though the intent of Osawa is to increase undercut or overhang of the photoresist profile to facilitate subsequent lift-off, it would have still been obvious to use the opposite effect to reduce undercut

and edge curl by using a negative photoresist, such as the negative electroconductive photosensitive paste material taught by Masaki and Felton, to reverse the image profile shown in Figure 2 of Osawa; resulting in rounding of the upper edges of the negative resist patterned profile for counteracting edge curl formation. A logical extension of the Osawa concept for forming rounded upper corners in a single layer electroconductive film pattern when applied to patterning of a multilayer electroconductive film structure would be to reduce the width or size of each successive photosensitive electroconductive film layer, resulting in a stepped built-up multilayer structure as taught by either Bloomstein '170 or Bloomstein '234. Both Bloomstein '170 and Bloomstein '234 teach that sequential patterning of each successive photosensitive layer to form a stepped built-up multilayer structure offers greater optimization of structural elements and increased flexibility in design. Such a stepped multilayer structure would have eased upper corners and would have been expected to counteract extension of upper corners during subsequent baking to result in reduced edge curl for a thick combined electroconductive film structure.

Claims 6-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Masaki et al. (Japanese Patent Publication 8-227153 A) in view of Felton (US Patent 5,874,197), further in view of either Bae et al. (US Patent 5,830,624) or Dentinger et al. (US Patent 5,830,624), further in view of Osawa (Japanese Patent Publication 6-077106 A), further in view of either Bloomstein et al. (US Patent 6,777,170) or Bloomstein et al. (US Patent 6,833,234), and further in view of Engstrom (US Patent 4,223,083).

Masaki, Felton, either Bae or Dentinger, Osawa, and either Bloomstein '170 or Bloomstein '234 do not specify changing the distance between a mask and a photosensitive material to change or reduce the size of the exposure region for each successively patterned photosensitive layer.

Engstrom describes the well-known effect on exposure image size caused by changing the distance between a mask and a photosensitive material. Figure 1 shows a first alternative image size projected through mask 14 onto photosensitive material 12 and Figure 3 shows a second alternative smaller image size projected through mask 16 over a shorter distance onto photosensitive material 19 (both are described at column 3 line 49 to column 5 line 8).

It would have been obvious to one of ordinary skill in the art at the time the invention was made in the process taught by Masaki, Felton, Osawa, and either Bloomstein '170 or Bloomstein '234 to change or reduce the exposure image size by changing or decreasing the distance between the mask and the photosensitive material as shown and described by Engstrom. This is because the same effect of first wider peripheral exposure of a first layer of photosensitive material and second or subsequent narrower central overlapping exposure of each successive layer of photosensitive material could be obtained by simply reducing the distance between the mask and each successive layer of photosensitive material between successive overlapping exposures of each layer of photosensitive material, without changing the mask (instant claim 6 and instant claim 7 for the reasons discussed above).

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Yamada (US Patent 6,426,733) describes an image forming apparatus having an electron source and a method for manufacturing the apparatus.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to John Ruggles whose telephone number is 571-272-1390. The examiner can normally be reached on Monday-Thursday and alternate Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

John Ruggles
Examiner
Art Unit 1756

MARK F. HUFF
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700